

WHAT IS CLAIMED IS:

1. A polymer matrix composite material, comprising:
 - (1) a polyurethane formed by reaction of a reaction mixture, comprising:
 - (a) one or more monomeric or oligomeric poly- or di-isocyanates;
 - (b) a first polyol selected from the group consisting of polyether polyols and polyester polyols, having a first molecular weight; and
 - (c) an optional second polyol selected from the group consisting of polyether polyols and polyester polyols, having a second molecular weight lower than the first molecular weight; and
 - (2) an optional polyisocyanurate formed by reaction of a monomeric or oligomeric poly- or di-isocyanate with water which has been optionally added to the reaction mixture;
 - (3) an inorganic particulate material.
2. The polymer matrix composite material of claim 1, wherein the material is foamed.
3. The polymer matrix composite material of claim 1, further comprising one or more inorganic fibers disposed throughout the polymer matrix.
4. The polymer matrix composite material of claim 1, further comprising axially oriented fiber rovings disposed on, in, or beneath the surface of the composite.

5. The polymer matrix composite material of claim 1, wherein the second polyether polyol is present in an amount between 0 and about 20 wt% of the first polyether polyol.
6. The polymer matrix composite material of claim 1, wherein the inorganic particulate material is present in an amount ranging between about 45 wt% and about 80 wt%, based on the total weight of the composition.
7. The polymer matrix composite material of claim 1, wherein the inorganic particulate material is a fly ash, bottom ash, or particulate glass.
8. The polymer matrix composite material of claim 1, wherein the inorganic particulate material has a particle size distribution ranging from about 0.0625 in. to below about 325 mesh.
9. The polymer matrix composite material of claim 1, wherein the inorganic particulate material contains less than about 0.5 wt% water.
10. An synthetic lumber, comprising the polymer matrix composite material of claim 1;
wherein the composite material comprises a relatively porous material and a relatively non-porous toughening layer disposed on and adhered to the porous material.

11. The synthetic lumber of claim 10, having a size and shape corresponding to that of commercially available lumber products.
13. The synthetic lumber of claim 11, wherein the synthetic lumber comprises at least on surface that has been embossed or impressed with a pattern.
14. The synthetic lumber of claim 13, wherein the pattern comprises a simulated wood grain.
15. A method of producing a polymer matrix composite, comprising:
- (1) mixing a first polyether polyol having a first molecular weight and a second polyether polyol having a second molecular weight higher than the first molecular weight with one or more catalysts, water, and optional surfactant;
 - (2) optionally introducing reinforcing fibrous materials into the mixture;
 - (3) introducing inorganic filler into the mixture;
 - (4) introducing poly- or di-isocyanate into the mixture; and
 - (5) allowing the exothermic reaction to proceed without forced cooling except to control runaway exotherm, thereby forming a polymer matrix composite.
16. The method of claim 15, further comprising extruding the mixture or the polymer matrix composite through a die.

17. The method of claim 16, wherein at least a portion of the mixing or reaction, or both occurs in an extruder.
18. The method of claim 15, further comprising molding the polymer matrix composite into a desired shape.
19. The method of claim 16, further comprising forming the polymer matrix composite into a synthetic lumber.
20. The method of claim 19, wherein the forming comprises shaping the polymer matrix composite into a size and shape suitable for synthetic lumber.
21. The method of claim 20, wherein the forming further comprises embossing or impressing at least one surface of the polymer matrix composite with a pattern.
22. The method of claim 15, wherein the one or more catalysts comprise a skin-forming catalyst.
23. The method of claim 22, wherein the skin-forming catalyst comprises an organic tin compound.
24. The method of claim 15, wherein the one or more catalysts comprise a gelation catalyst.

25. The method of claim 24, wherein the gelation catalyst comprises an amine.
26. The method of claim 15, further comprising introducing axially oriented fiber rovings into the polymer matrix composite.
27. The method of claim 26, wherein the fiber rovings are introduced on, in, or beneath the surface of the composite.